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Sennikov, Alexander N.

2020-10

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Sennikov , A N & Lazkov , G A 2020 , ' Taxonomic revision of two Iranian Arenaria endemics reveals further synonyms in Eremogone (Caryophyllaceae) ' , Annales Botanici Fennici , vol. 57 , no. 4-6 , pp. 223-226 . <https://doi.org/10.5735/085.057.0405>

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<http://hdl.handle.net/10138/323390>

<https://doi.org/10.5735/085.057.0405>

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Authors: Sennikov, Alexander N., and Lazkov, Georgy A.

Source: Annales Botanici Fennici, 57(4-6) : 223-226

Published By: Finnish Zoological and Botanical Publishing Board

URL: <https://doi.org/10.5735/085.057.0405>

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## Taxonomic revision of two Iranian *Arenaria* endemics reveals further synonyms in *Eremogone* (Caryophyllaceae)

Alexander N. Sennikov<sup>1,2,\*</sup> & Georgy A. Lazkov<sup>3</sup>

<sup>1)</sup> Botanical Museum, Finnish Museum of Natural History, P.O. Box 7, FI-00014 University of Helsinki, Finland (\*corresponding author's e-mail: alexander.sennikov@helsinki.fi)

<sup>2)</sup> Herbarium, Komarov Botanical Institute of Russian Academy of Sciences, Prof. Popov Str. 2, RU-197376 St. Petersburg, Russia

<sup>3)</sup> Laboratory of Flora, Institute of Biology, Kyrgyz Academy of Sciences, 720071 Bishkek, Kyrgyz Republic

Received 20 Apr. 2020, final version received 1 June 2020, accepted 1 June 2020

Sennikov A.N. & Lazkov G.A. 2020: Taxonomic revision of two Iranian *Arenaria* endemics reveals further synonyms in *Eremogone* (Caryophyllaceae). — *Ann. Bot. Fennici* 57: 223–226.

Two recently described endemics of northern Iran are reduced to synonyms: *Arenaria assadii* to a synonym of *Eremogone brachypetala*, and *A. longibracteata* to a synonym of *E. macrantha*. Both species were already known from the same places in Iran but were overlooked in the latest treatments. Nomenclatural data are verified and corrected for all the taxa involved.

Phylogenetic studies have recently confirmed the generic status of *Eremogone* (Caryophyllaceae), which was resolved outside *Arenaria* and placed in a separate tribe, Eremogoneae (Harbaugh *et al.* 2010, Sadeghian *et al.* 2015). Following the dismemberment of *Arenaria s. lato*, a number of new combinations in *Eremogone* for species described from the Old World have been provided (Rabeler & Wagner 2015).

Iran is a recognised centre of the global diversity of vascular plants, with a total of 2597 (sub)endemic species documented (Noroozi *et al.* 2019). Among these endemics, three species recently described under *Arenaria* (Fadaie *et al.* 2010, Fadaie 2013) are actually referable to *Eremogone*. Intentionally or not, these species were omitted from the list of Rabeler and Wagner (2015). One of those presumed local endemics, *A. kandavanensis* from northern Iran was

recently reduced to a synonym of *Eremogone fursei* by Lazkov and Sennikov (2020).

Two further local endemics, *A. assadii* and *A. longibracteata*, described in *Arenaria* by Fadaie (2013) but belonging in *Eremogone*, are evaluated in this study in order to contribute to the revision of the latter genus.

The protologues of *A. assadii* and *A. longibracteata* (Fadaie 2013) were examined and compared with previous treatments and revisions of *Arenaria s. lato* in Iran and the Caucasus (Schischkin & Knorring 1936, McNeill 1967, Popova 1972, Rechinger 1988, Nersesian 2004, Lazkov 2012). Type specimens were examined *de visu* or from scanned images (available at JSTOR Global Plants) or photographs. Diagnostic characters were evaluated on the basis of published treatments and our revision of herbarium material from Iran and the Caucasus at LE.

We compared the presumed endemics *A. assadii* and *A. longibracteata* (Fadaie 2013) with taxa occurring in the Caucasus (Lazkov 2012). That comparison revealed that these species have long been known from the same places in Iran under other names.

### ***Eremogone brachypetala* (Grossh.)**

Czerep.

Sosud. Rast. SSSR: 160. 1981. — *Arenaria graminea* var. *brachypetala* Grossh., Beih. Bot. Centralbl. 44(Abt. 2): 209. 1927. — *Arenaria brachypetala* (Grossh.) T.N. Popova, Novosti Sist. Vyssh. Rast. 9: 160. 1972. — TYPE: Iran. East Azerbaijan: “Prope Tebriz, in lapidosis, 1500 m”, 25 June 1924 *A. Grossheim* [Grossheim & Schischkin, Plantae orientales exsiccatae no. 278] (lectotype LE!, designated by Popova (1972: 160); isotypes LE!, K barcode K000723968 photo!, TBI barcodes TBI1024893 and TBI1024894 photo!, TGM).

*Arenaria assadii* Fadaie, Iran. J. Bot. 19(1): 35. 2013, *syn. nov.* — TYPE: Iran. West Azerbaijan: Khoy, 1300 m a.s.l., 28 June 2003 *M. Assadi 85212* (holotype TARI, photo!).

*Arenaria assadii* was described as a relative of *A. blepharophylla* (= *Eremogone blepharophylla*), from which it was said to differ in longer sepals (4–5 mm long) and petals that are shorter than sepals (Fadaie 2013). These characters perfectly match *Eremogone brachypetala* (*syn. Arenaria brachypetala*) (Popova 1972), which was described from the same area in Iran (Iranian Azerbaijan) but neglected by Rechinger (1988) and Fadaie (2013). The distribution of this species extends from southern Armenia and Nakhchivan Autonomous Republic of Azerbaijan to Iranian Azerbaijan (Popova 1972, Nersesian 2004, Lazkov 2012).

The plants of *A. graminea* with shorter petals had been originally described as a variety (Grossheim 1927, Lazkov 2002), which was later elevated to the level of species (Popova 1972, Czerepanov 1981, Lazkov 2012). *Eremogone brachypetala* is indeed most closely related to *E. graminea*, from which it differs mainly in the petals being half as long as or nearly reaching the length of sepals (*vs.* 1.5 times longer than sepals) and a compact inflorescence with shorter pedicels (Popova 1972, Nersesian 2004). Their distributions do not overlap (Nersesian 2004).

In Iran, *E. brachypetala* is known from two localities. The type locality is situated near

Tebriz in East Azerbaijan. The second locality at Khoy in West Azerbaijan, from which *A. assadii* was described, seems to coincide with the place where the oldest specimen was collected (“Tshilachana” Mts. [Chelleh Khaneh = Çillə Xana Dağı, 15 km N of Khoy, at 38.68°N, 45.00°E], 31 May 1828 *J. Szovits* (LE); Nersesian 2004).

### ***Eremogone macrantha* (McNeill) Ikonn.**

Novosti Sist. Vyssh. Rast. 10: 138. 1973. — *Arenaria macrantha* Schischk., Fl. USSR 6: 886. 1936, *nom. illeg., non* (Rydb.) Nelson 1909. — *Arenaria holostea* subsp. *macrantha* McNeill, Notes Roy. Bot. Gard. Edinburgh 24(3): 297. 1963. — TYPE: Turkey. Iğdır: “Takjaltu” [Takeltu], 10 June 1913 *Yu. Woronow 12254* (holotype LE!).

*Arenaria longibracteata* Fadaie, Iran. J. Bot. 19(1): 35. 2013, *syn. nov.* — TYPE: Iran. West Azerbaijan: road Shahpur to Rezaieyeh, Ghoushi pass, 1750 m a.s.l., 21 May 1976 *H. Runemark & H. Foroughi 19588* (holotype TARI, photo!).

Fadaie (2013) distinguished *A. longibracteata* from *A. szowitsii* by longer cauline leaves (5.5–6.5 cm *vs.* 2.8–5.3 cm), glabrous (*vs.* glandular) pedicels, much longer floral bracts (7–7.5 mm *vs.* 2.5–4.5 mm), and typically longer sepals. These characters exactly point at *Eremogone macrantha* (Popova 1972), which has larger flowers and remarkably long floral bracts, easily distinguishing this species among the relatives.

*Eremogone macrantha* had already been reported from Iranian Azerbaijan (as *Arenaria holostea* subsp. *macrantha*) from the same area as the type locality of *A. longibracteata* (Rechinger 1988), but it was treated as *A. holostea* by Fadaie (2013). The affinity of *A. longibracteata* with *E. macrantha* rather than *E. szowitsii* can be seen in the basal parts of the plant: *A. longibracteata* and *E. macrantha* have a thick caudex, with several stems coming from a rootstock, whereas *E. szowitsii* has thin, branched rhizomes with few sparsely situated stems (Popova 1972).

*Eremogone macrantha* was originally characterised by basally pubescent stems, as opposed to the glabrous stems of *E. holostea* (Schischkin & Knorring 1936, Rechinger 1988). The stems of *A. longibracteata* are glabrous (Fadaie 2013). This character is unstable and may vary in *E. macrantha*, which consistently differs from *E. holostea* in longer sepals (8–11 mm *vs.* 6.5–8 mm) and

petals (10–14 mm vs. 8–10 mm) (Popova 1972). The dimensions of flower parts in *A. longibracteata* and *E. macrantha* closely coincide; the sepals in *A. longibracteata* are 8–10 mm long and the petals are 10–12 mm long (Fadaie 2013).

The illustration in the protologue of *A. longibracteata*, showing a plant with numerous long non-flowering shoots, is at odds with the life form in *Eremogone*. The presumed sterile shoots in the illustration are actually generative shoots, which are developing stems yet without flowers. Thickened upper parts of these shoots indicate that the absence of flowers could be due to insect damage; otherwise, the shoots in *Eremogone* develop simultaneously and do not follow each other with a delay.

*Eremogone macrantha* is distributed in the South Caucasus, namely in Azerbaijan, Armenia, Turkey and Iran (McNeill 1967, Rechinger 1988, Lazkov 2012). Its type locality (Takeltu; 39.746°N, 44.438°E) is situated on the eastern side of Mount Ararat in Turkey, at a distance of 5 km from the border with Iran. *Eremogone holostea*, the small-flowered counterpart of *E. macrantha*, is distributed in the North Caucasus (Lazkov 2012).

The authorship of the name *E. macrantha* is commonly cited as “(Schischk.) Ikonn.” That citation is incorrect because Schischkin (Schischkin & Knorring 1936) published an illegitimate later homonym. The first legitimate name for this taxon, provided by McNeill (1963), should be treated as a basionym for all further nomenclatural transfers.

## Conclusions

This study highlights the importance of comprehensive inventories which should include all literature published in the country under study and in all neighbouring countries, ideally leading to a global database. In the case of Iranian *Eremogone*, such omissions and oversights included taxa that have been already reported or even described from the country; these omissions led to superfluous descriptions of “new local endemics” of Iran.

Besides producing “taxonomic noise”, superfluous descriptions of non-existent endemics

may potentially obscure or even alter the picture of real endemism and biodiversity hotspots. Noroozi *et al.* (2019) concluded that the Azerbaijan Plateau, which harbours both “*Arenaria assadii*” and “*A. longibracteata*”, is a national biodiversity hotspot which includes 21% of Iranian vascular plant endemics, half of which are endemic to this area. Nevertheless, the flora of the Azerbaijan Plateau is largely shared with eastern Turkey, Transcaucasia and the Caucasus (Noroozi *et al.* 2019), where *Eremogone brachypetala* and *E. macrantha* actually occur. Further studies may increase this share and correspondingly decrease the number of plant endemics in the Iranian Azerbaijan Plateau.

## Acknowledgements

Our sincere thanks go to an anonymous reviewer of our earlier paper for his kind suggestions that triggered this little study.

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